

# Canadian Space Station Program

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**Director General**  
**Canadian Space Station Program**

**August 6, 1991**  
**League City, Texas**



**Mobile Servicing System**    **Système d'entretien mobile**



**Canadian Space Agency**

**Agence spatiale canadienne**

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# The Canadian Space Station Program

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- **Mobile Servicing System**
  - **Development, use and operation**
- **Strategic Development**
  - **Space station utilization and operations**
  - **Evolution**
  - **Technology development**
  - **User development**
  - **Industrial development**



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# Mobile Servicing System

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- **Canada's contribution provides essential facility for assembly, maintenance and servicing of Space Station**
- **Required to support several phases:**
  - **assembly**
  - **initial operations**
  - **mature operations**
  - **evolution**



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## **Major impacts of restructuring on Canadian Program**

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- **MSC delivery to orbit phased, MB 3 and MB 6**
- **MT operates only along one face of truss**
  - **Routine orbiter/station logistics tasks no longer possible from MT as base**
  - **Direct operations viewing by operator impeded**
- **MSC control from aft node and STS**



# Assembly Sequence Launch Manifest

Date	Flight	Assembly elements
11/95	1 FEL MB-1	Truss section (S3/4) with stbd indb PV system, alpha joint, propulsion module platforms, passive dampers, MT, unpressurized berthing adapter
12/95	2 MB-2	Truss section (S2) with CMGs, C&T (S-band), two propulsion modules, S-2 avionics
3/96	3 MB-3	Truss section (S1) with stbd TCS, UHF and KU-band antennas, SSRMs
6/96	4 MB-4	Truss section (M1) with IUD, MTS, GCS , cryo berthing mechanisms (2), node 1&2 umbilicals, CETA cart (2), MT batteries
9/96	5 MB-5	Aft port node, Pressurized Docking Adapter (PDA), cupola
12/96	6 MTC MB-6	U.S. lab module core - A, system racks, 4 user payload racks, MBS (ASRMs required)
3/97	7 MB-7	Airlock, pressurized docking adapter, SPDMMMD
5/97	UF-1	Mini PLM, Cryo O2/N2
6/97	8 MB-8	Truss section (P1) with port TCS, C&T (UHF ant.)
9/97	9 MB-9	Truss section (P2) with dry cargo berthing mechanisms (3), 2 propulsion modules

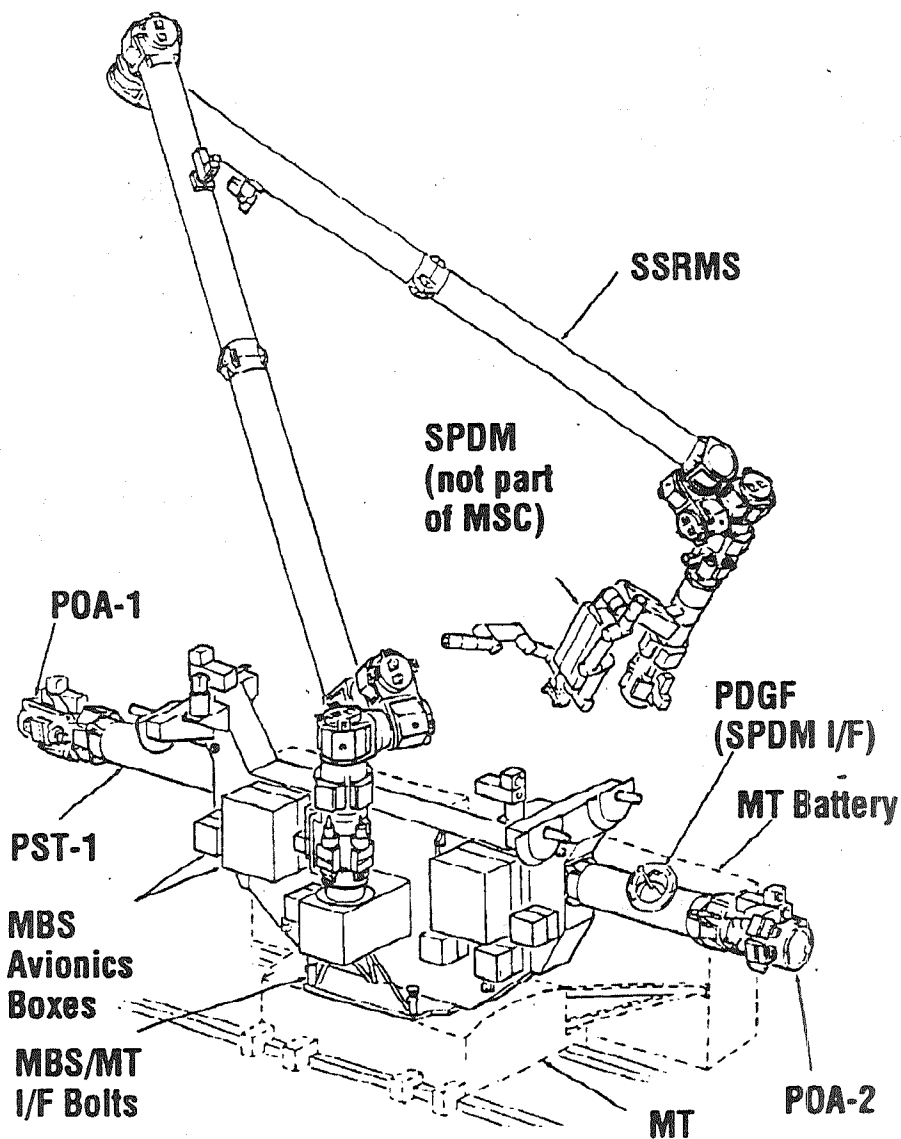


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# Mobile Servicing Centre

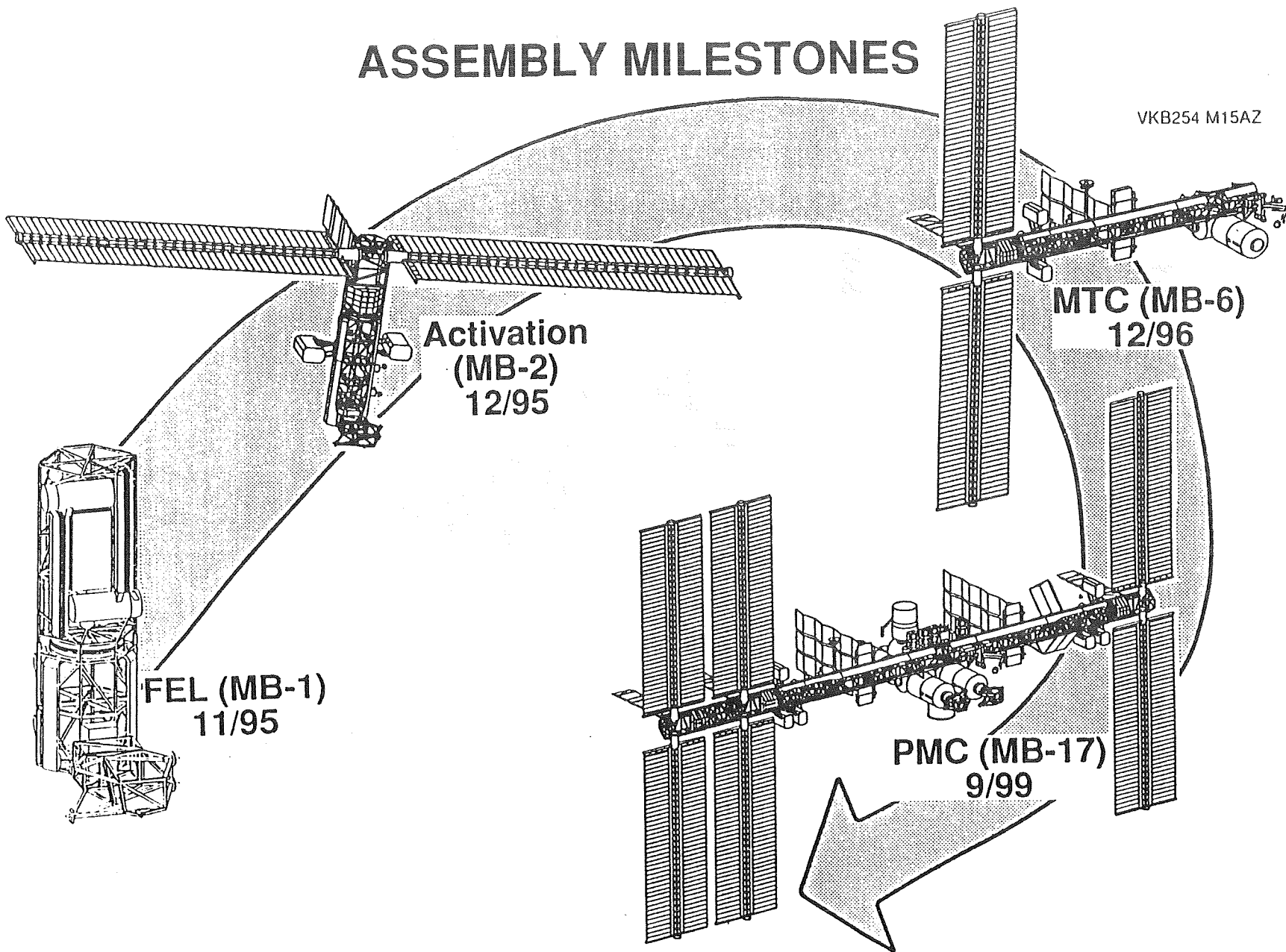


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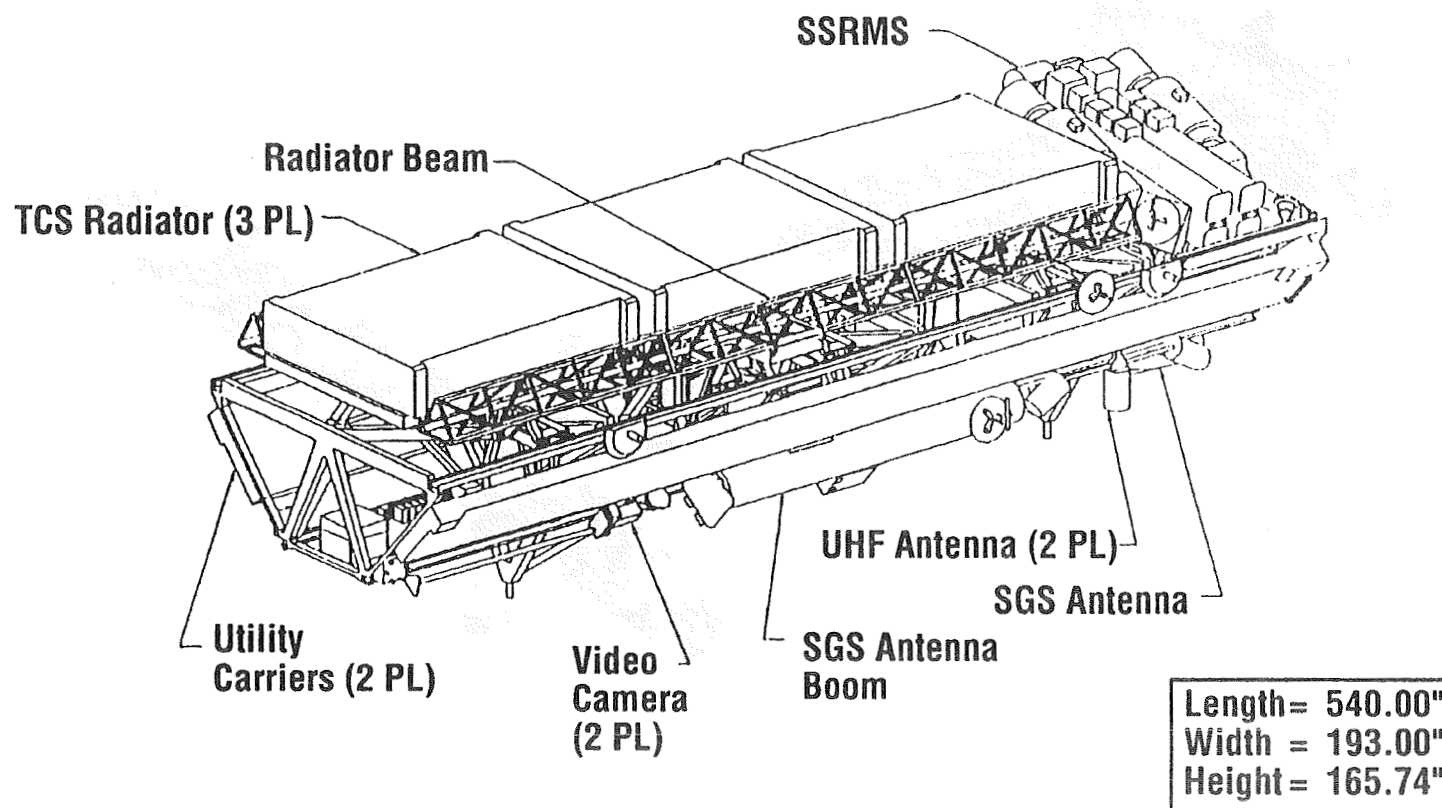
# ASSEMBLY MILESTONES



—Space Station Freedom—



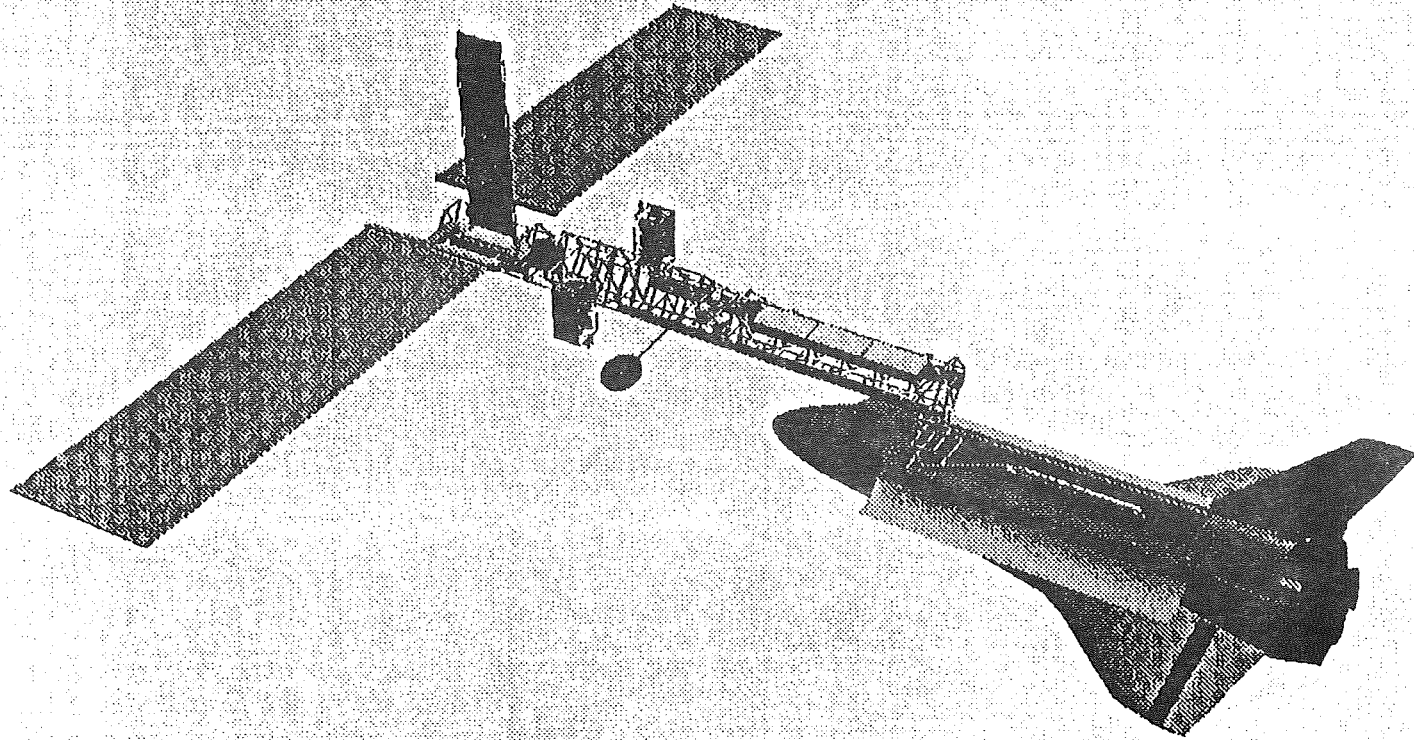
# MB-3 Launch Configuration



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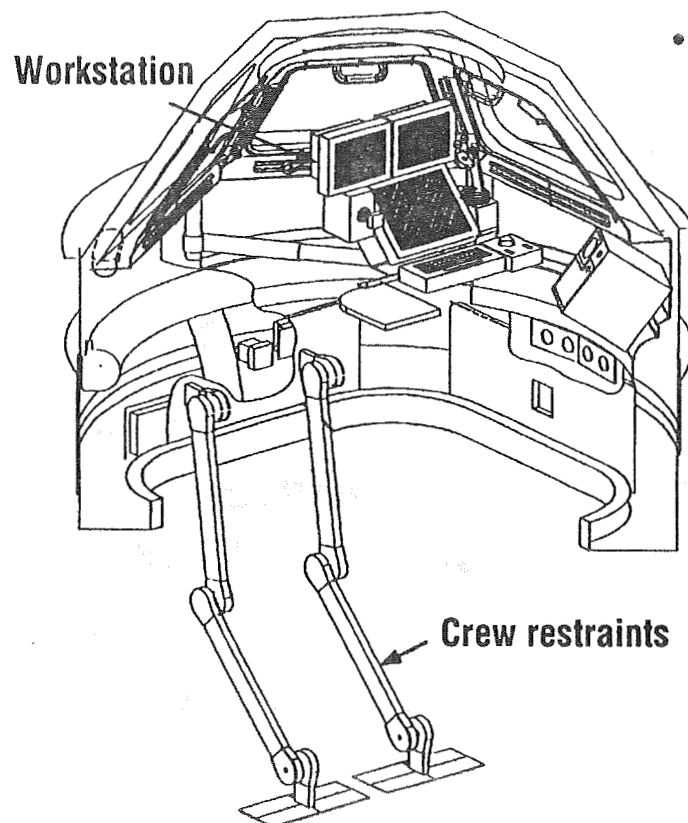
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**MB-3**



**Space Station Freedom**

# Cupola



- One Workstation
  - New workstation configuration
    - PDR: 2-14", 5-10" displays
    - 2x6 DOF hand controllers
    - Programmable display
    - Pushbuttons,
    - master alarm lights
  - DPDR: 1-14", 2-10" displays
  - 2x3 DOF handcontrollers
  - no programmable display
  - pushbuttons,
  - no master alarm lights



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# MSS Development Status

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- **Engineering model hardware manufacturing 70% complete**
- **Detailed flight system design for MB 3 deliverables 35% complete**
- **Engineering development facilities in operation**
  - **Simulation facility (MDSF)**
  - **SPDM test rig**
  - **Full-scale mockups**



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# Canadian Program Status

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**Program is fully funded at \$1.2B until year 2000**

## **Mobile servicing system development**

<b>Phase A</b>	<b>Program definition (completed)</b>	<b>1984-85</b>
<b>Phase B</b>	<b>Concept development (completed)</b>	<b>1985-87</b>
<b>Phase C1</b>	<b>Preliminary design (completed)</b>	<b>1987-90</b>
<b>Phase C2</b>	<b>Detailed design (in progress)</b>	<b>1990-92</b>
<b>Phase D</b>	<b>Manufacture and test</b>	<b>1992-95</b>
<b>Phase E</b>	<b>Launch of 1st Canadian element (MB-3)</b>	<b>1996</b>
	<b>Operations Phase</b>	<b>1996-2025</b>

## **User development**

- **Ongoing program**

## **Technology development**

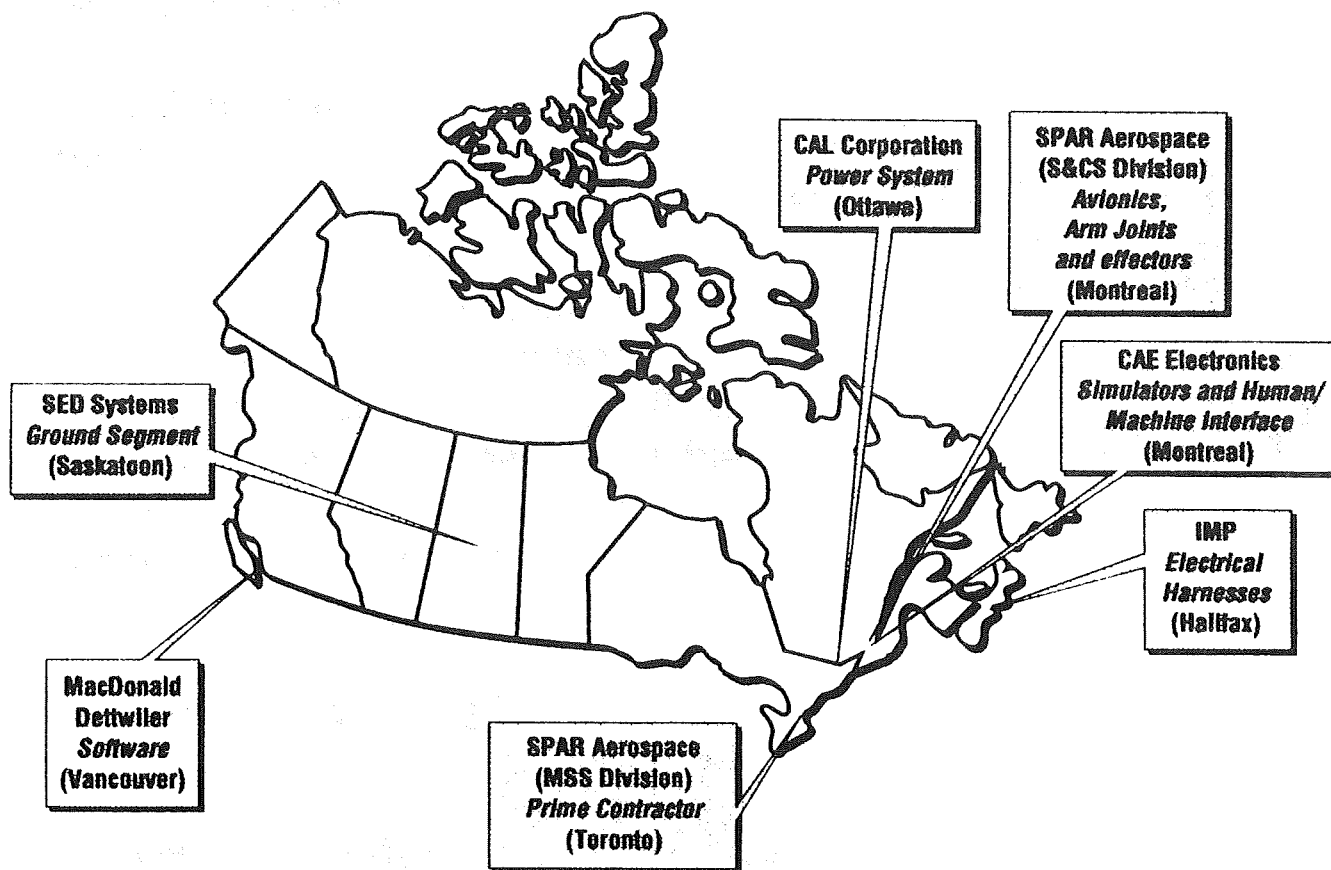
- **Ongoing program**



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# Strategic Development

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- **Development of strategic technologies and industry for MSS**
- **Space station operations and utilization**
- **Space station user development**
- **Space station evolution**



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# Strategic Technology Development

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- **Areas of technology**
  - **Automation of operations**
  - **Automated power management**
  - **Autonomous robotics**
  - **Enhanced space vision systems**
  - **Trajectory planning and collision avoidance**
  - **Protection of materials in space**
  - **Tactile sensors**



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# User Development Program

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- **Objective:** To develop potential users of the microgravity environment on Space Station, with emphasis on potential commercial applications and the necessary underlying science, especially in materials science and biotechnology



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# User Development Program

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- **Areas of current interest**
  - **Fluid dynamics**
  - **Chemistry**
  - **Crystal growth**
  - **Metals and alloys**
  - **Glasses and ceramics**
  - **Biotechnology**
  - **Combustion**



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## **Growth and Evolution**

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- **30 year life demands incorporation of advances in technology**
- **Operations experience and new requirements will demand evolution**
  - **Enhance capacity**
  - **Enhance capability**
  - **Evolve technology to support future missions**
- **Design to accommodate growth and evolution**
- **Pursue restructured space station development**
- **Achieve on-orbit operational experience as soon as possible**



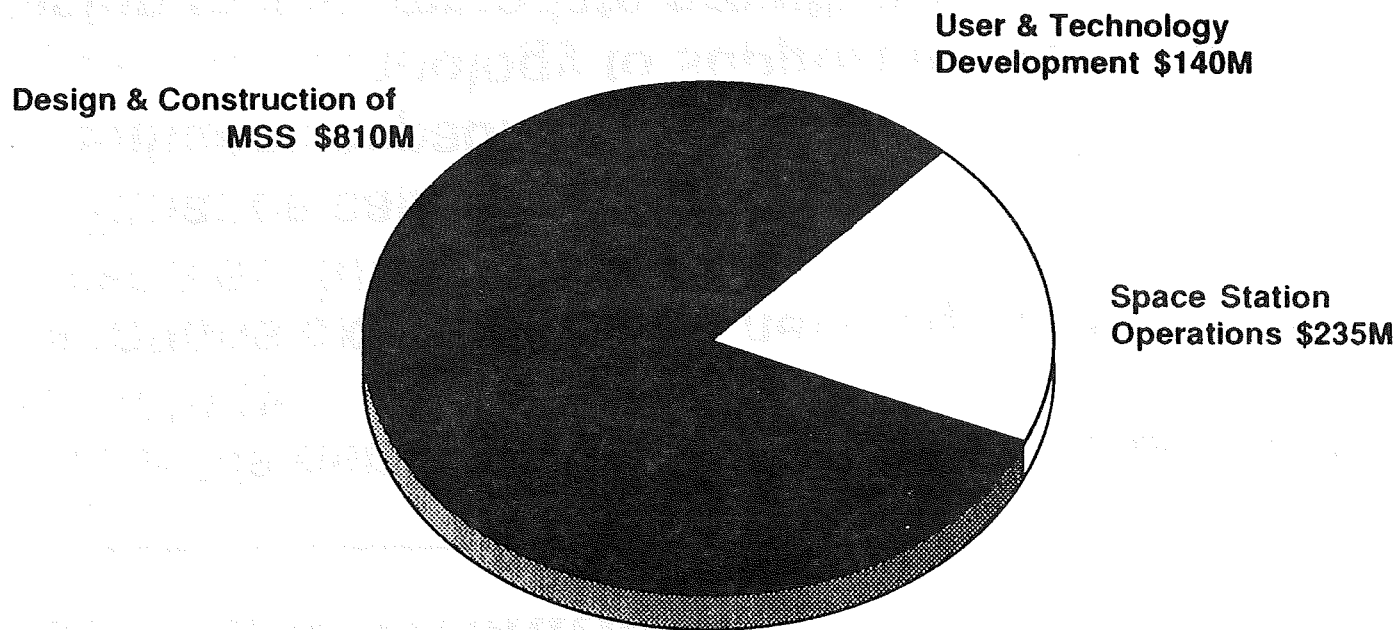
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# Space Station Program Budget

**1.185 billion 15 year total (1985-2000)**



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# Canada's Future Space Activity

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- Long term space plan is being developed for spring 1992 to provide options for Canada's future space participation
- International participation is a key factor in major programs
- Space station remains as a test case for future large scale projects and international cooperation



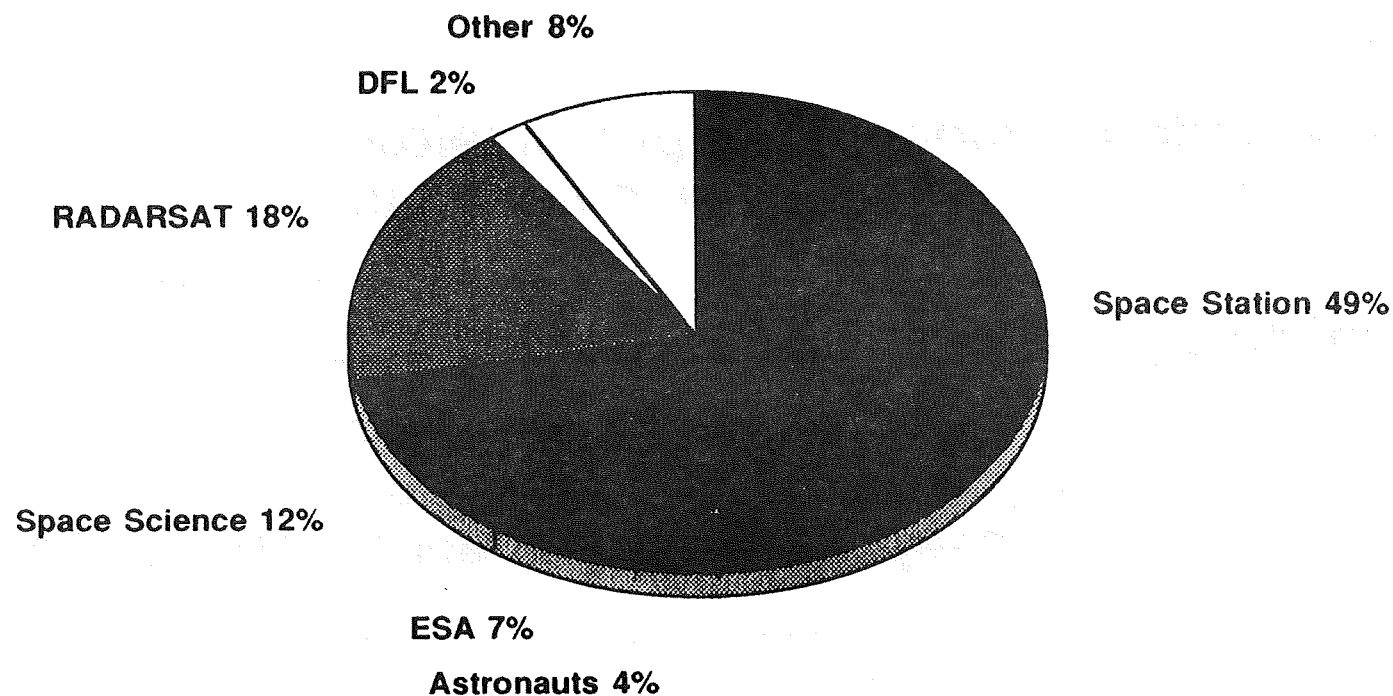
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# CSA Approved Budget \$2.7B

**1988/89-2000/01**



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